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Soft Corn for Fattening Cattle

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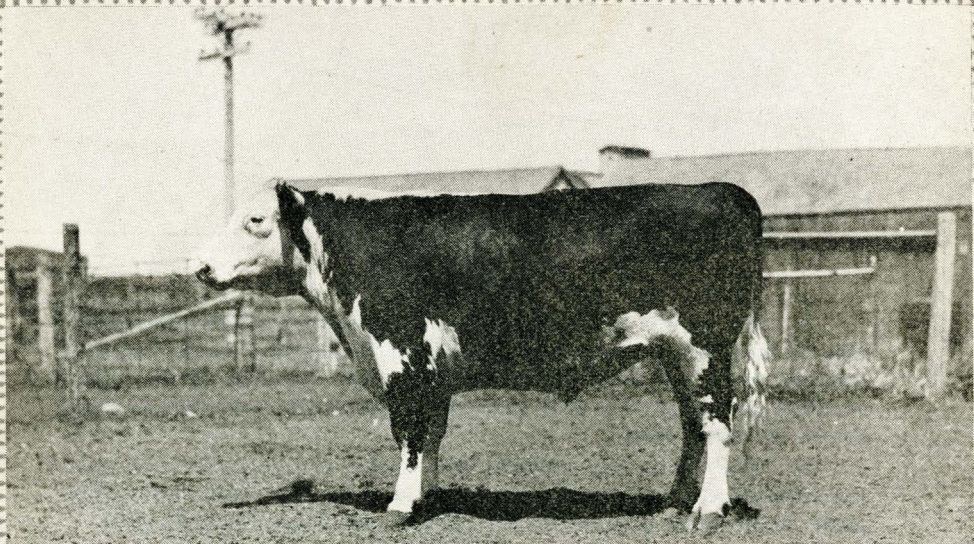

This steer gained 364 pounds in 90 days. The average daily gain was 3.74 pounds for 118 days, the largest gain ever made by a steer at this station.

SOFT CORN FOR FATTENING CATTLE

Agricultural Experiment Station
of the
South Dakota State College of
Agriculture and Mechanic Arts
Brookings

DIGEST

1. The results of this experiment indicate that farmers should plan to feed soft or immature corn rather than sell it on the market, because when fed with alfalfa hay soft corn produced gains which compare quite favorably with gains produced by the more mature corn grown the same year.

2. The results also indicate that husks on immature corn have considerable feeding value; steers fed snapped corn and alfalfa hay made better gains than steers fed husked corn from the same field.

3. This experiment shows that the low prices prevailing when the corn is soft are unnecessary.

4. The shrinkage of the steers that received the selected soft corn was not as large as it was with the steers that received the selected hard corn, being 60 and 64 pounds per head, respectively.

5. Results indicate that soft corn puts a good finish on cattle as the salesmen in the stockyards rated the steers that received the soft selected corn second, and the steers that received the hard selected fourth.

6. The four lots of corn fed to the four lots of steers in this experiment were found to contain, on close inspection, different classes of corn from the standpoint of maturity. The field run corn and even the soft selected corn contained three classes—medium hard, medium soft and soft. Even the hard selected corn, on close examination, contained two classes—hard and medium hard.

7. The chemical composition of the four lots showed no significant differences. When divided into classes on the basis of physical evidence of maturity, immaturity is shown by a higher total protein content, a lower per cent of normal starch, a somewhat lower per cent of crude fat, higher ash, higher moisture, a lighter weight per bushel and lower shelling per cent.

8. Chemical analyses of the husks from immature corn indicate that they should be more palatable and have greater nutritive value than husks from mature corn. Husks of immature corn were found to have a higher sugar content and true protein content than the husks of the more mature corn.

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Soft Corn for Fattening Cattle

J. W. WILSON and ALFRED L. BUSHEY

THIS bulletin reports the results of an experiment* in feeding ear corn and alfalfa hay to cattle during the winter of 1925. The corn crop of 1924 was soft; that is, it was not mature. This condition of the corn was not confined to the corn growing area of South Dakota, but was general throughout the corn belt in the northwest. It is a condition of the corn crop that is frequently encountered in the northern corn growing states.

Different ideas prevail as to the value of corn in this condition as a fattener for livestock as compared to the feeding value of mature corn. To secure information on this subject, a questionnaire was sent to several people. The replies were to the effect that the feeding value of soft corn varied all the way from 30 to 60 per cent of matured corn. Some claimed it should be fed early before cold weather. Others claimed it should be "steered" or "lambed" off since there was much nutriment in the husks and leaves when the ear failed to mature. Others were content in knowing it would make good silage.

In this connection, it might be well to re-state in brief the results reported in bulletin No. 182 of this station. Two tests in feeding silage made from corn put into the silo when the kernels of the ears were in the blister or milk stage, when in the dough stage, when in the glazed or dented stage and when the kernels were well matured and frosted, showed that the average of the gains for the two lots receiving the silage made from the immature corn was only .34 of a pound less per head daily than it was in the lots that received silage made from corn when the ears were in the glazed stage, the condition considered best for making silage.

The Experiment

This experiment was conducted in cooperation with the Department of Agronomy and the results are reported in two parts:

Part I. The detailed statement of feeding soft corn.

Part II. The physical characteristics and chemical constituents of the corn fed.

PART I.

The objects of the experiment were:

1. To ascertain the value of soft corn for fattening cattle and for pigs following the cattle.
2. To ascertain the value of matured corn from the same field grown under the same conditions for fattening cattle.

*Acknowledgement is given to A. H. Kuhlman and F. H. Helmreich of the Animal Husbandry department for assistance in this experiment.

3. To determine the per cent of matured corn and soft corn grown in the same field.
4. To ascertain the chemical composition of soft corn and also of matured corn from the same field.
5. To compare the feeding value of closely snapped corn to husked corn, not sorted, for fattening cattle from the same field.
6. To note the condition of different lots of steers at the close of the experiment and to sell the cattle in market on their merits.

Twenty head of high grade two-year-old Hereford steers, averaging 857 pounds, were selected at Miller, South Dakota. These cattle had been running in a stalk field and were in good condition for feeders. They were neither fat nor thin but good average steers, as

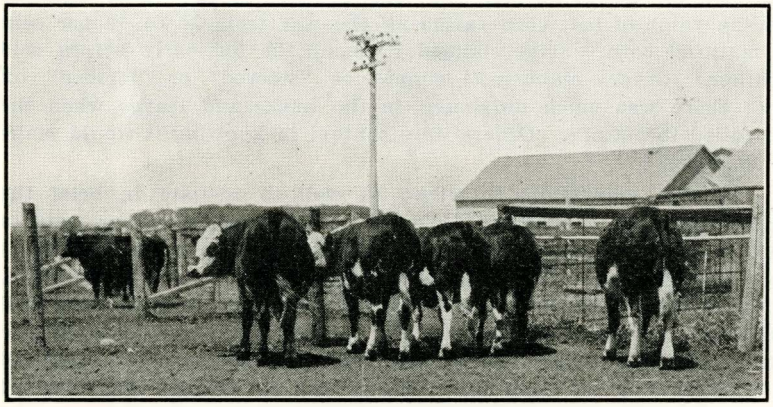

FIG. 1—STEERS IN LOT I

These steers received field run of snapped ear corn and alfalfa hay. The corn was purchased from a neighbor north of the College farm and was of the same variety as the husked corn fed to steers in Lot II. A per cent of this corn was soft and immature. In one sample of 100 pounds, there were 58 pounds classed as soft, 34 pounds of sound corn and 8 pounds of husks. Eighty-two pounds were allowed for a bushel.

Record on Steers in Lot I from January 30 to May 28, 1925

Number of days fed	118
Average weight at beginning, 3 days in succession	855
Average weight at close, 3 days in succession	1217
Average gain per head	362
Average gain per head daily	3.06
Total pounds snapped ear corn fed	21868
Total pounds alfalfa hay fed	2227
Pounds snapped corn for a pound of gain	12.0
Pounds of alfalfa hay for a pound of gain	1.23
Pounds of beef for bushel corn fed	6.78
Pounds of pork for bushel of corn fed	3.24

uniform in quality, size and age as it was possible to get them. They were shipped to the Experiment Station and divided into four lots of five head each. From the table of weights and gains, it will be noted that there was only a small difference in weight between any two lots. Enough pigs were put in each lot to pick up the waste.

These cattle were accustomed to eating corn, differing in this respect from some of the range cattle used in feeding experiments. The largest daily rations fed per head were as follows: Lot I.—50 pounds of snapped corn; Lot II.—43 pounds of husked corn; Lot III.—43 pounds of soft selected corn; Lot IV.—44 pounds of hard selected corn.

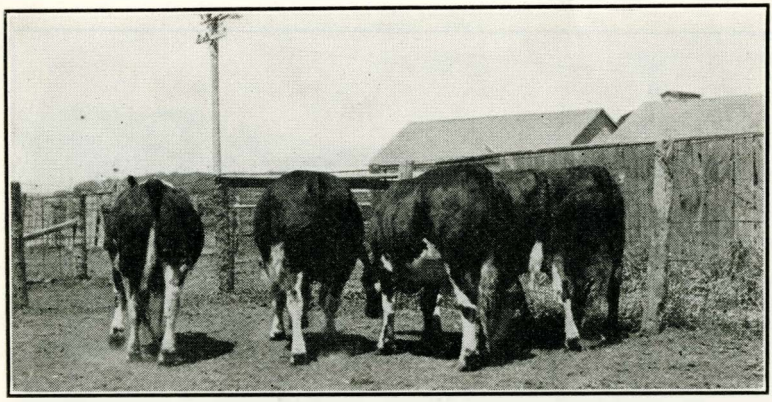

FIG. 2.—STEERS IN LOT II

This lot received field run of husked ear corn of the same variety as Lot I. Part of the kernels were shelled off the cob as it was picked with a corn picker. There is, therefore, a larger per cent of cobs to corn in this lot than in Lot I. During the latter part of the test, the cattle shelled the corn off the cob instead of eating the ear.

Record on Steers in Lot II from January 30 to May 28, 1925

Number of days fed	118
Average weight at beginning, 3 days in succession	858
Average weight at close, 3 days in succession	1193
Average gain per head	335
Average gain per head daily	2.84
Total pounds husked ear corn fed	19281
Total pounds alfalfa hay fed	2301
Pounds ear corn for pound of gain	11.49
Pounds alfalfa hay for pound of gain	1.37
Pounds beef for bushel 75 pounds of corn fed	6.52
Pounds pork for bushel corn fed	2.58

The average daily ration per head for Lot I was 37 pounds of snapped corn and 3.7 pounds of alfalfa hay; for Lot II, 32 pounds of field run of husked corn and 3.9 pounds of alfalfa hay; for Lot III, 32 pounds of soft selected corn and 5.4 pounds of alfalfa hay; for Lot IV, 31 pounds of hard selected corn and 5.0 pounds of alfalfa hay. The corn for Lots I and II was obtained from the same field and corn for Lots III and IV from another field. All corn was of the yellow dent variety. The alfalfa hay had a small quantity of bluegrass in it. Each lot had salt and water at all times. During the latter part of the experiment, part of the ears in the soft corn lot became mouldy. This may have influenced to an extent the gains for this lot. The corn for Lots III and IV was hand selected on the basis of maturity.

FIG. 3.—STEERS IN LOT III

The aim was to have corn for this lot as soft as possible so a field run of yellow dent corn raised on the College farm was hand selected. These steers were fed this soft selection. Steers in Lot IV were fed the hard selection or the ears that were apparently ripe. In making this division, by actual weight nearly 50 per cent of the field run of this corn was selected as being immature. During the latter part of the experiment, these soft ears had started to mold.

Record on Steers in Lot III from January 30 to May 28, 1925

Number of days fed	118
Average weight at beginning, 3 days in succession	851
Average weight at close, 3 days in succession	1214
Average gain per head	362
Average gain per head daily	3.06
Total pounds selected soft ear corn fed	19212
Total pounds alfalfa hay fed	3206
Pounds soft ear corn for pound of gain	10.60
Pounds alfalfa hay for pound of gain	1.21
Pounds beef for bushel 75 pounds soft corn fed	7.06
Pounds pork for bushel soft corn fed	2.43

Enough hogs were put in each lot to pick up the waste. Whenever any of the hogs reached market weight and condition they were sold and replaced by unfinished hogs. As a result, two groups of hogs were used in each lot. One more pig was required in Lot I where snapped corn was fed than in the other lots where husked corn was fed.

The cattle were shipped to the Chicago market after they had been fed 118 days and were sold on their merits. The steers in each lot were placed by a committee of cattle salesmen in the yards as follows: steers in Lot II, first; Lot III, second; Lot I, third; Lot IV, fourth.

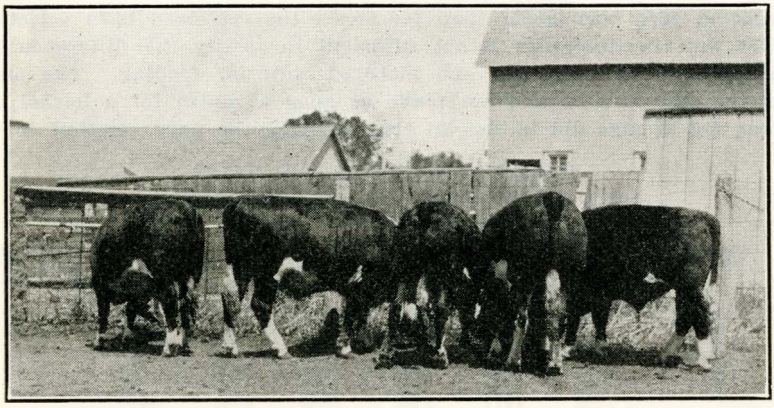

FIG. 4.—STEERS IN LOT IV

These steers received the hard selection of the field run of corn raised on the College farm. This selected corn from all appearances was ripe. Of the hundreds of steers fed at this station and weighed up individually every 30 days, steer No. 29 in this lot has the record of making the largest average daily gain. During the first 90 day period, he made an average daily gain of over four pounds. For the entire period he made 3.74 pounds daily.

Record on Steers in Lot IV from January 30 to May 28, 1925

Number of days fed	118
Average weight at beginning, 3 days in succession	863
Average weight at close, 3 days in succession	1232
Average gain per head	368
Average gain per head daily	3.12
Total pounds of selected hard corn fed	18594
Total pounds of alfalfa hay fed	3007
Pounds of hard selected ear corn for pound of gain	10.08
Pounds of alfalfa hay for pound of gain	1.63
Pounds beef for bushel 75 pounds of hard corn fed	7.43
Pounds pork for bushel hard corn fed	2.76

Shrinkage In Shipping

The shrinkage in shipping to market, after being unloaded once enroute, varied from 49 to 65 pounds per head per lot. The largest shrinkage came in the lot that received the snapped corn and smallest in the lot that received field run of husked corn of the same variety. The shrinkage is based on the average of the last three weighings of the experiment and the final weight at the market. This shrinkage is not considered large but about average for cattle of this weight.

From the records of Lots III and IV, it is evident that .52 of a pound more of the soft selected corn was required to produce a pound of gain than was required in Lot IV where the hard selected corn was fed. The average daily ration per head for steers that received soft selected corn was larger than for steers that received hard selected corn but the difference is not sufficient to justify the difference in prices paid for soft corn and matured corn for feeding. The pigs in the soft corn lot did not make as good a return for a bushel of corn fed as pigs did in the lot that received the hard selected corn.

TABLE I.—WEIGHTS AND GAINS

Lot I.—Fed Snapped Ear Corn and Alfalfa Hay

Steer No.	Weight Beginning	Mar. 2	Mar. 31	Apr. 30	May 28	Gain	Average gain per head daily
25	796	916	994	1080	1178	382	3.23
37	869	954	1042	1140	1225	356	3.01
26	792	894	980	1074	1162	370	3.13
31	1028	1130	1206	1308	1381	353	2.99
27	793	920	968	1058	1140	347	2.94
Totals	4278	4814	5190	5660	6086	1808	
Averages	855	962	1038	1132	1217	361	3.06
Lot II.—Fed Husked Ear Corn and Alfalfa Hay							
23	734	866	952	1040	1120	386	3.27
22	974	1082	1150	1198	1310	336	2.84
21	794	940	976	1016	1094	300	2.54
43	941	1028	1084	1194	1253	312	2.64
30	849	958	1036	1130	1192	343	2.90
Totals	4292	4874	5198	5578	5969	1677	
Averages	858	974	1039	1115	1193	335	2.84
Lot III.—Fed Soft Selected Ear Corn and Alfalfa Hay							
32	865	996	1050	1160	1261	396	3.44
33	743	832	940	1060	1132	389	3.29
34	860	960	1018	1120	1180	320	2.71
20	942	1008	1080	1164	1231	289	2.44
36	849	966	1036	1178	1266	417	3.53
Totals	4259	4762	5124	5682	6070	1811	
Averages	851	952	1024	1136	1214	362	3.06
Lot IV.—Fed Hard Selected Ear Corn and Alfalfa Hay							
24	729	822	890	990	1072	343	2.90
35	725	834	922	1022	1121	396	3.44
41	946	1004	1102	1220	1276	330	2.79
29	1004	1154	1250	1368	1436	432	3.74
45	912	988	1050	1168	1255	343	2.90
Totals	4316	4802	5214	5768	6160	1844	
Averages	863	960	1042	1153	1232	368	3.14

The analyses of the corn, found in Part II, Table IV, show that both the grain and the cob of the corn fed Lot III contain much more moisture than that fed other lots. This corn froze in real cold weather and molded in warm weather, two conditions of feed not desirable for best results. However, the cattle seemed to eat the corn in these conditions and no serious reductions in gains resulted when the feeds were so affected, as may be seen from Table I. When the cattle were marketed, they were in extra good condition as shown by the pictures on the following pages. Detail records for each lot are found beneath the pictures.

When it is considered that only ear corn and alfalfa hay were fed, the individual gains made by these steers are good. Ear corn in this condition and alfalfa hay furnished an excellent ration. From the table of weights and gains it may be seen that the most uniform gains were made by steers in Lot I that received the snapped corn.

PART II.

PHYSICAL CHARACTERISTICS AND CHEMICAL CONSTITUENTS OF CORN FED IN THE EXPERIMENT*

The corn crop of 1924 over a large part of the corn belt was characterized as soft. This is a recurrent condition and may be attributed to either unusually cool weather during the growing period or to an early frost or to both.

The corn crop over part of the area devoted largely to corn is subjected to freezing temperatures before maturity even on average years. This may occur far south of the northern boundary and over a large or small area. Consequently, there are very few years in which the corn crop over all of the corn belt reaches maturity without frost. Over most of the corn belt, the average temperature was below normal during the growing season of 1924.

TABLE II.—MONTHLY TEMPERATURE AND PRECIPITATION OF 1924 COMPARED TO TEN PREVIOUS YEARS

	Mean Temperature		Precipitation	
Month	1914-23 incl. Average	1924	1914-23 incl. Average	1924
May	54.6	49.6	3.15	1.32
June	65.4	62.8	4.64	6.88
July	71.5	67.7	3.02	1.22
August	68.0	68.3	2.45	3.89
September	60.2	57.3	2.04	1.02

*This part of the bulletin is a contribution of the agronomy department by Alfred L. Bushey, agronomy analyst.

At Brookings, the mean temperature for 1924 is shown in comparison to the average of 10 previous years for the months as indicated in Table II.

The first killing frost of 1924 occurred on September 28 as compared to the dates given in Table III for the previous ten years.

TABLE III.—DATE OF FIRST KILLING FROST IN LAST ELEVEN YEARS AT BROOKINGS, S. D.

Year	First Killing Frost	Year	First Killing Frost
1914	Oct. 11	1920	Oct. 1
1915	Oct. 5	1921	Oct. 4
1916	Sept. 15	1922	Oct. 9
1917	Oct. 7	1923	Oct. 5
1918	Sept. 8	1924	Sept. 28
1919	Oct. 11		

The immature condition of the corn may be attributed to the cool season and late spring rather than an unusually early killing frost.

Despite the experimental date* available the value of the immature corn crop of 1924 was a mooted question among the farmers and experiment station workers and large amounts of corn were disposed of at extremely low prices because of the variation in opinion regarding its value. It is not always possible to evaluate a feed on the basis of its chemical analysis alone but the chemical analysis may serve as an index to results which may be expected. The object of this phase of the experiment was to correlate the composition of various grades of corn with their performance in the feed yard and to describe the lots of corn so that reference may be made for future comparison.

The Lots of Corn

The four lots of corn were used in this analytical work which were fed to the four lots of steers in the feeding experiment. The lot numbers used in designating the corn in this section of the bulletin correspond to the lot numbers of the steers to which this corn was fed.

*Work by Spitzer, Carr and Epple, involving the chemical composition of soft corn as compared to that of mature corn with special emphasis upon the groups of nitrogenous compounds, shows that the greatest difference is in the non-protein portion classed as amid nitrogen. They also note that the immature samples contain less crude fat and similar percentages of protein and starch. Analyses included in work published by Kennedy, et al, Bulletin 75, Iowa Experiment Station, indicate a similar chemical composition for "soft" and hard corn.

Data on the chemical composition of corn at various stages of maturity are available in work by Hopper (N. D. Bulletin 192), Ince (N. D. Bulletin 117), Jones & Huston (Indiana Bulletin 175), Ladd (Report Geneva New York Agr. Exp. Sta.) and others. The samples in above work were secured from the field at definite stages of development.

Lot I was field run corn which had been "snapped."

Lot II was field run corn of the same variety as Lot I.

Lot III was selected "soft corn" from field run corn grown on the College farm.

Lot IV was the corn selected as "hard" from the college grown corn. This lot was probably representative of the most mature corn which could be secured from this community.

Analyses of samples of these four lots are reported in Table IV.

TABLE IV.—ANALYSIS OF GRAIN, COBS AND HUSKS OF FOUR LOTS OF CORN USED IN EXPERIMENT. (WATER FREE BASIS)

Lot No.	Moisture	Protein	Ash	Ether Extract	Sugar	Starch via Diastase	% grain field condition	% grain air dry
				Grain				
1	21.1	12.77	1.81	3.33	1.98	55.8	71.22	72.01
2	25.7	12.71	1.80	3.18	2.19	54.8	71.18	74.06
3	28.1	12.66	1.67	2.73	1.68	54.1	72.19	75.27
4	20.9	11.10	1.54	4.06	1.93	56.0	77.97	76.53
				Cobs			% ear wet	% ear dry
1	28.99	2.82	1.45	.454	2.72		28.77	27.98
2	28.51	2.72	1.81	.378	2.12		28.01	25.93
3	38.65	2.66	1.67	.253	2.67		27.80	24.72
4	21.65	2.37	1.45	.326	2.85		22.02	23.41
				Husks from Lot I			% ear wet	% ear dry
	8.72	3.32	2.66	.738	7.72	2.72	7.90	9.26

Comparing Lots III and IV, a consistent variation in chemical composition is evident. Lot III shows a higher moisture content, higher ash, a decrease in ether extract which is largely oil; less starch and sugar, a higher protein content, and lower shelling per cent. However, it would not be expected that the differences noted in composition would be measurable in the feed yard and the results might even be reversed from the expected due to the softness and consequent ease of mastication of the more immature samples. In utilizing the ear corn, the difference in shelling per cent may be significant.

In Lot I (snapped corn), the lower moisture content is significant because this lot was from the same field as Lot II and any differences should be attributed to the fact that one had the husk removed while the other had not. Aside from the moisture content, the chemical composition of Lots I and II correspond fairly well with Lot II and indicate about the same degree of maturity.

If the amount of moisture in grain and cob were the only indication of maturity, Lot III would evidently rank as the most immature lot; but on the basis of physical appearance it is evident

from Table V that this lot is made up of more mature ears than Lots I and II. The time of harvesting and method of storage prior to selection for this work may have contributed to this difference in moisture content.

The Classes of Corn

It is common observation that in field run corn the degree of maturity varies and this is particularly noticeable in "soft corn" years. In Lot I and II this variation was very evident and to a less degree in Lots III and IV. In order to adequately describe the above lots, it was thought advisable to formulate some arbitrary classes on the basis of physical appearances. The classes used were called No. 1 (hard); No. 2 (medium hard, dent); No. 3 (medium soft, dough); No. 4 (soft, milk).

Class No. 1 includes those ears which are not easily twisted; the kernels close together, hard, and dry; and the kernels free from chaff when shelled.

Class No. 2 could be described as those ears which could be twisted, kernels quite well filled, hard, but some having chaff attached when shelled.

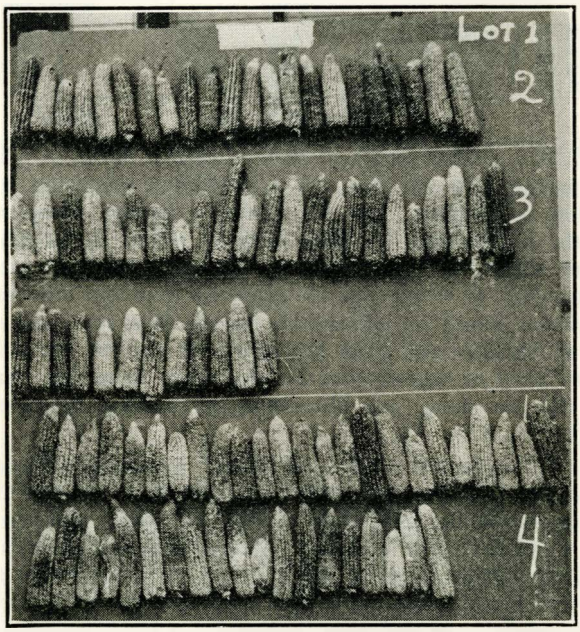

FIG. 5.—THIS IS A SAMPLE OF THE CORN FED LOT I
It is divided into classes 2, 3 and 4. The white line indicates the boundary between classes.

Class No. 3 included those ears which could be easily twisted, kernels shrunken and a large per cent of the kernels soft, chaff attached to most of the kernels when shelled.

Class No. 4 comprised the most immature ears on the basis of chaffy, shrunken kernels, very loose on cob, and practically all kernels having chaff adhering when shelled.

The selection of the ears on the basis of the above classes was arbitrary and the groups merged so gradually into one another that part of each class could possibly be placed in either of the groups on each side. Each ear varies from every other ear in physical appearance and chemical composition but the above groups constitute a practical basis for selection. By increasing the number of groups, the variation would become so slight that much experience would be required to make selections.

Using the above classification as a basis, about 100 ears of each lot were scooped into bags and separated into classes, allowed to air dry in the laboratory and the weight of each class secured. From these data, the per cent of each class found in the four lots was determined as shown in Table V.

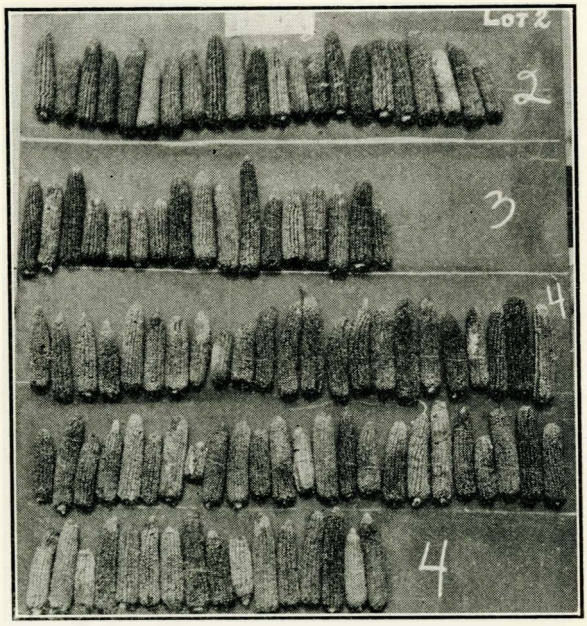

FIG. 6.—THIS IS A SAMPLE OF THE CORN FED LOT II

It is similar to Lot I except that husks were removed at the time of harvesting. Three classes were represented in this lot.

TABLE V.—PER CENT OF EACH CLASS IN VARIOUS LOTS (ON AIR DRY BASIS)

Class No.	Lot 1	Lot 2	Lot 3	Lot 4
1	—	—	—	33
2	23	22	36	66
3	35	36	50	—
4	42	42	14	—

The lots as indicated above are made up of varying fractions or classes as previously noted. In Lots III and IV it is evident that similar corn on the basis of maturity are included in each. In Lots I and II the presence of three classes, viz. class 2 (medium hard), class 3 (medium soft), class 4 (soft), would be expected.

Representative portions of each class as well as samples of cobs were prepared for analysis. The husks were left on the ears in Lot I until the ears were divided into the respective classes and were then detached and husks from each class prepared for analysis.

Lots III and IV together constitute the field run of college corn, consequently the following data on college corn applies to Lots III and IV on the basis of their division in Table V.

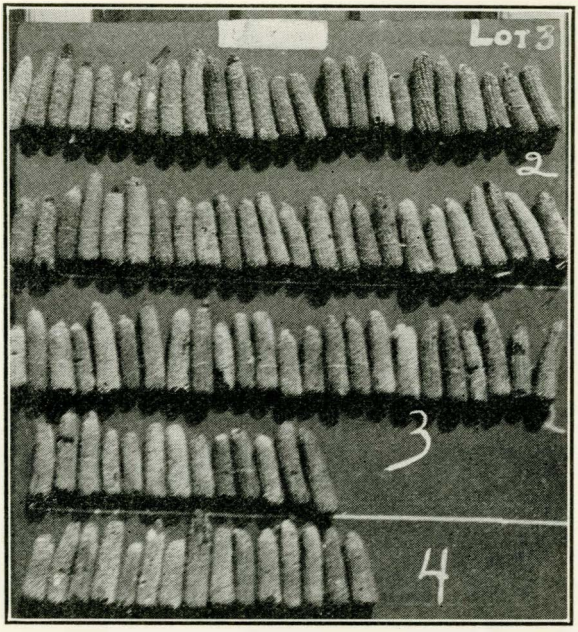

FIG. 7.—THIS IS A SAMPLE OF THE CORN FED LOT III

It was the more immature portion of the corn crop as grown on the College farm. The three classes into which this lot was divided are shown.

TABLE VI.—ANALYSES OF CLASSES FROM THREE LOTS OF CORN. (WATER FREE BASIS)

	% Moisture	Ash	Protein	Ether Extract (crude fat)	Sugar	Starch (by Diastase)	Weight per bushel shelled grain	Shelling percent
Lot III and IV.—College.								
Class 1	20.83	1.68	11.34	3.80	2.10	56.13	55lb	77.8
Class 2	21.93	1.76	11.41	3.21	1.92	54.28	52lb	77.1
Class 3	26.78	1.82	12.03	3.26	2.10.	54.79	47lb	76.2
Class 4	28.63	1.98	13.44	2.93	2.22.	48.77	41lb	71.8
Lot I.—Snapped.								
Class 2	19.11	1.56	12.23	3.72	2.09	57.21		
Class 3	23.29	1.76	12.63	3.05	2.06	55.39		
Class 4	23.50	1.95	14.35	2.81	1.99	50.50		
Lot II.—Husked.								
Class 2	21.85	1.63	11.30	3.62	2.16	58.13		
Class 3	27.65	1.66	11.55	3.31	2.06	55.58		
Class 4	28.81	1.97	14.03	2.85	2.13	51.04		

Regarding the protein content, it appears that if what is termed crude protein were a substance of comparable composition in all cases, the classes which represent the most immature corn would constitute a better nitrogeneous feed than the sound corn.

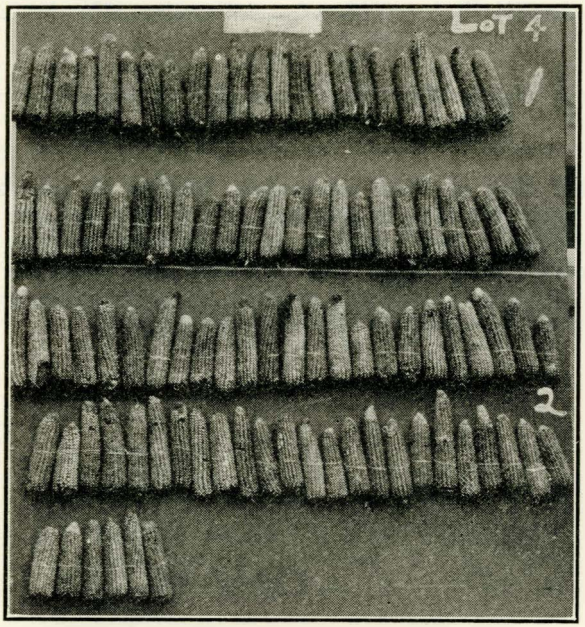

FIG. 8.—THIS IS A SAMPLE OF THE CORN FED LOT IV
It is the mature corn as selected from college grown sample. Two classes are shown in this lot.

Table VII indicates the per cent of water soluble nitrogeneous material and if we assume that the non-protein fraction is not useful for growth and maintenance it is possible that the higher protein samples may not be superior in this respect.

TABLE VII.—WATER SOLUBLE NITROGEN (NON-PROTEIN AND ALBUMIN) AS PER CENT OF SAMPLE AND OF TOTAL NITROGEN

Lots	Crude Protein percent	Non-protein N % of sample	Non-protein N % of total nitrogen	Albumin N % of sample	Albumin N % of total nitrogen
College:					
Class 1	11.34	.160	8.85	.089	4.95
Class 2	11.41	.162	8.86	.104	5.66
Class 3	12.03	.194	9.62	.116	6.04
Class 4	13.44	.206	10.03	.174	8.11
Lot 1:					
Class 2	12.23	.177	9.10	.092	4.71
Class 3	12.63	.182	9.13	.161	8.07
Class 4	14.35	.216	9.47	.191	8.35
Lot 2:					
Class 2	11.30	.161	8.90	.142	7.47
Class 3	11.55	.168	9.09	.150	8.14
Class 4	14.03	.197	9.35	.193	8.64

The per cent of total non-protein fraction in all the above samples is high but if it is assumed that a high per cent of non-proteid nitrogen is representative of immaturity we can bear in mind even the corn in Class 1 was probably not completely matured before the killing frost and that some of the polypeptides and amino acids had not been converted into the true proteins.

TABLE VIII.—ANALYSIS OF COBS FROM EACH OF THE CLASSES FROM COLLEGE CORN (LOTS 3 AND 4) AND LOTS 1 AND 2. (WATER-FREE BASIS)

	Ash %	Crude protein %	Starch via diastase %	Sugar		Ether extract %
				Total	Reducing	
College:						
Class 1	1.24	2.22	3.85	2.95	2.83	.31
Class 2	1.44	2.19	2.54	2.89	2.85	.35
Class 3	1.49	2.35	2.13	3.13	3.04	.35
Class 4	1.64	2.72	1.68	1.84	1.63	.30
Lot 1:						
Class 2	1.36	2.12	2.41	2.48	2.41	.21
Class 3	1.45	2.31	2.28	1.52	1.49	.24
Class 4	1.67	2.59	1.85	1.92	1.80	.32
Lot 2:						
Class 2	1.24	2.31	2.51	2.33	2.20	.27
Class 3	1.40	2.56	2.58	2.82	2.91	.48
Class 4	1.80	2.63	1.88	1.69	1.51	.34

TABLE IX.—ANALYSIS OF HUSKS FROM EACH CLASS IN LOT 1. (WATER-FREE BASIS)

	Ash	Crude Protein	Ether Extract	Sugar		Starch
				Total	Reducing	
Class 2	3.54	3.00	.95	6.98	5.92	2.41
Class 3	3.03	3.14	.88	7.48	6.73	2.17
Class 4	2.62	4.03	1.20	10.81	9.26	2.35

It appears from the above analysis that sugars and proteins are trans-located from the husk as the corn matures.

From the crude protein of the husk, the water soluble protein was separated and determined as non-protein and albumen N.

	Total protein % N X 6.25	Non-protein N % of sample	Non-protein N % of total	Albumen N % of sample	Albumen N % of total N
Class 2	3.00	.177	36.80	.106	22.08
Class 3	3.14	.176	35.14	.100	19.91
Class 4	4.037	.202	31.27	.0942	14.58

No special significance is usually attached to the value of corn husks, but it appears from the above analysis, that the husks of immature corn may be quite valuable as feed for cattle.

The higher protein content in the husks from Class 4 is not due to smaller amount of storage carbohydrates but is associated with it; consequently it may be assumed that the structural carbohydrates are present in greater proportion in husks from Class 2.

The per cent of non-protein nitrogen decreases slightly toward maturity but when computed on the basis of per cent of total nitrogen, the higher per cent of crude protein in Class 4 brings about a reduction in the per cent of total protein which is present as non-protein nitrogen. More of the protein in Class 4 is present as true protein than in either Class 2 or 3.

The albumen nitrogen of the husks increased with maturity as did the per cent of total nitrogen present as albumen. The increase in nitrogen content of husks in Class 4 is therefore true protein and is a significant increase over Class 2.

The use of the term "soft" in describing corn is based upon physical appearance and certain physical characters are associated with a difference in chemical composition. However, it is noteworthy that the difference between the composition of the most immature, "chaffy" corn in Class 4 (Table VI) and the best corn, Class 1 (Table VI) was not greater than could be expected upon analysis of mature corn on average years which had been grown under different environment. It would hardly be expected that a difference of 7 per cent in normal starch, 1 per cent in fat and 2 per cent in protein content would be noticeable in the feed lot.

Regarding the quality of protein, it appears that the more immature corn has a true protein content equally as high or higher than the more mature samples.

In Lot I, which had part of the husk attached, the lower moisture content of corn, and similar moisture content of cob to Lot 2, would bear out popular assumption that the husk aids in drying out the corn.

Regarding the husks of Lot I, the high sugar content is significant. From Table IX it may be noted that the more immature corn may have a husk which is quite high in sugar and indicates that translocation from husks of soluble carbohydrates is probably discontinued when frost injury occurs. On the other hand, less sugar and starch is found in the cobs of the most immature corn (Table VII) than in the more mature. In Lots I and II we find the starch and sugar in the cobs of hard, medium hard and medium soft very similar in amount.

In the husks, the water soluble protein increases in per cent of total protein with maturity and varies from about 45 per cent in Class 4 to over 58 per cent in Class 2.